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Journal of Fire Sciences.****Nonformaldehyde Flame Retardant Finishing of the
Nomex/Cotton Blend Fabric Using a Hydroxy-Functional
Organophosphorus Oligomer**

Hui Yang and Charles Q. Yang

Journal of Fire Sciences, Sep 2007; vol. 25: pp. 425 - 446.

...weave fabric weighing 219g/m2. HFPO with the trade name of 'Fyroltex HP' (also known previously as 'Fyrol 51', CA Registry No. 70715-06-9) was supplied by Akzo Nobel Functional Chemicals, Dobbs Ferry, New York. BTCA, TEA, and hypophosphorus acid (H₃PO₂, as...

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1 Identification of substance

Product details

Trade name: **FYROLTEX HP**

Application of the substance / the preparation Fire retarding agent

Manufacturer/Supplier:

Supresta
 420 Saw Mill River Road
 Ardsley, NY 10502
 USA

Information department:

Product safety department.
 1-914-269-5900 (9:00 am - 5:00 pm EDT)

Emergency information:

Medical: PROSAR 1-888-875-1685 (24HRS)
 Transportation: CHEMTREC 1-800-424-9300 (24 HRS)

2 Composition/Data on components

Chemical characterization

Description: Substance is a compound and/or mixture.

Chemical Components:

70715-06-9	Phosphonic acid, methyl-, dimethyl ester, polymer with oxirane and phosphorus oxide	80 - 95%
512-56-1	trimethyl phosphate	.001 - 1.5%
75-21-8	ethylene oxide	.001 - .1%
756-79-6	dimethyl methylphosphonate	.001 - 2%
123-91-1	1,4-dioxane	.001 - .005%
75-07-0	acetaldehyde	.001 - .1%
109-86-4	2-methoxyethanol	.001 - .1%
	Proprietary Epoxy Resin	2.5 - 3%

Carcinogenicity status (IARC, NTP, OSHA)

This product may contain a listed carcinogen at a concentration of 0.1% or greater:

Ethylene oxide (CAS No. 75-21-8): IARC 2A carcinogen; it is also listed as a carcinogen by NTP, OSHA and NIOSH.

Acetaldehyde (CAS No. 75-07-0): IARC 2B carcinogen; it is also listed as a carcinogen by NTP and NIOSH.

3 Hazards identification

WHMIS-symbols: D2A - Very toxic material causing other toxic effects

NFPA ratings (0=minimal, 1=slight, 2=moderate, 3=severe, 4=extreme)



Health = 2
 Fire = 1
 Reactivity = 0

HMIS ratings (0=minimal, 1=slight, 2=moderate, 3=serious, 4=severe)



Health = *2
 Fire = 1
 Reactivity = 0

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· **Additional information:**

Caution!

May cause eye, skin and respiratory tract irritation.

May be harmful if inhaled.

4 First aid measures

· **After inhalation:**

Remove to fresh air. If not breathing, clear victim's airway and start artificial respiration. If victim is breathing, supplemental oxygen may be given from a demand-type or continuous-flow inhaler, preferably with a physician's advice. Get medical attention immediately.

· **After skin contact:**

Immediately remove and discard contaminated clothing and shoes. Under a safety shower, wash all affected areas with plenty of soap and water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Obtain medical attention immediately.

· **After eye contact:**

Immediately flush eyes with large amounts of water for at least 15 minutes. Hold eyelids apart to ensure rinsing of the entire surface of the eye and lids with water. Do not attempt to neutralize the material. Get medical attention immediately.

· **After swallowing:**

Get medical attention by calling a physician or a poison control center immediately. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, keep head below hips to reduce the risk of aspiration. Never give anything by mouth to an unconscious person.

· **Information for doctor:** Attending physician should treat exposed patients symptomatically.

5 Fire fighting measures

· **Suitable extinguishing agents:**

Use water fog or spray, dry chemical, foam or carbon dioxide extinguishing agents.

· **Special hazards caused by the material, its products of combustion or resulting gases:**

This product is not defined as flammable or combustible. However, the product may support combustion and decompose under fire conditions. It is not sensitive to static discharge or physical impact.

Decomposition of this product under fire conditions can produce carbon monoxide, carbon dioxide, and phosphorus oxides.

This material decomposes nonviolently above 200F (93.3C) to form acids.

· **Protective equipment:**

As in any fire, prevent human exposure to fire, smoke, fumes or products of combustion. Evacuate non-essential personnel from the fire area. Firefighters should wear full-face, self contained breathing apparatus and impervious protective clothing. If possible, move containers from the fire area. If not leaking, keep fire exposed containers cool with a water fog or spray to prevent rupture due to excessive heat. High pressure water may spread product from broken containers increasing contamination or fire hazard. Dike fire control water for later disposal. Do not allow contaminated water to enter waterways.

6 Accidental release measures

· **Personnel-related safety precautions:**

Isolate spill area and restrict nonessential personnel. All personnel involved in spill cleanup should follow appropriate industrial hygiene practices (see Section 8).

Particular danger of slipping on leaked/spilled product.

· **Measures for environmental protection:**

Stop source of spill if possible. Dike area to prevent spill from spreading.

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· **Measures for cleaning/collecting:**

Soak up liquid with a suitable absorbent such as clay, sawdust, or kitty litter. Sweep up absorbed material and place in a chemical waste container for disposal. Cover spill area with a slurry of powdered household detergent and water. Use stiff brush to work slurry into cracks and crevices. Allow to stand for 2-3 minutes, then flush with water. Dike water for later disposal. Do not allow contaminated water to enter waterways or sewers.

7 Handling and storage

· **Handling:**

· **Information for safe handling:**

Keep away from heat, sparks and open flame. Avoid contact with eyes and skin. Avoid inhalation of vapors and mist. Personnel handling this product should wash thoroughly after contact with this product. Containers should be located in an area where they can be rotated regularly (first in, first out) and visually inspected for dents and bulging on a weekly basis.

· **Information about protection against explosions and fires:** The product is not flammable.

· **Storage:**

· **Suggested Storage Conditions:**

This material is noncorrosive to glass or metals. However, because the material has plasticizing properties, it may soften or deteriorate certain plastics and elastomers (particularly vinyl-based resins, neoprene and natural rubbers).

· **Information about storage in one common storage facility:**

Store away from foodstuffs and animal feed. Containers should be stored in a cool, dry, well-ventilated area away from flammable or oxidizing materials and sources of heat or flame.

· **Further information about storage conditions:** Maximum storage temperature is 122 F (50 C).

8 Exposure controls and personal protection

· **Additional information about design of technical systems:**

This material should be handled in a well-ventilated area. Use sufficient natural or mechanical ventilation to prevent employee exposure to vapors, aerosol or mists.

Where adequate ventilation is not available, respiratory protection should be used.

· **Additional Occupational Exposure Limit Values for possible hazards during processing:**

75-21-8 ethylene oxide (.001-.1%)	
OSHA PEL	Short-term value: 5 ppm Long-term value: 1 ppm see 29 CFR 1910.1047(a)(2)
NIOSH REL	Short-term value: C 9* mg/m ³ , C 5* ppm Long-term value: <0.18 mg/m ³ , <0.1 ppm *10-min/day
ACGIH TLV	1.8 mg/m ³ , 1 ppm
75-07-0 acetaldehyde (.001-.1%)	
OSHA PEL	360 mg/m ³ , 200 ppm
NIOSH REL	Lowest feasible conc.
ACGIH TLV	Short-term value: C 45 mg/m ³ , C 25 ppm

· **Personal protective equipment:**

· **General protective and hygienic measures:**

The primary routes of exposure to this product are skin contact and inhalation.

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- **Breathing equipment:**

Use a NIOSH-approved organic vapor/acid gas respirator (OVAG) with dust, mist and fume filters to reduce potential for inhalation exposure if use conditions generate vapor, mist or aerosol and adequate ventilation (e.g., outdoor or well ventilated area) is not available. Where exposure necessitates a higher level of protection (e.g., if breakthrough resulting in dizziness or numbness is experienced) use a NIOSH-approved, positive pressure, pressure demand, air-supplied respirator.

- **Protection of hands:**

Skin contact with liquid or its aerosol should be prevented through the use of suitable protective clothing, gloves and footwear selected with regard for use condition exposure potential.

- **Material of gloves** Nitrile rubber, NBR

- **Eye protection:**

Eye contact with liquid or aerosol should be prevented through the use of chemical safety goggles or a face shield selected with regard for use condition exposure potential. Eye wash fountains or other means of washing eyes with a gentle flow of water should be readily available in all areas where this product is handled or stored. Water should be supplied through insulated and/or heat-traced pipes to prevent freeze-up in winter.

- **Body protection:**

Safety showers, with quick opening valves which stay open and eye wash fountains or other means of washing the eyes with a gentle flow of cool to tepid tap water should be readily available in all areas where this material is handled or stored. Water should be supplied through insulated and heat-traced lines to prevent freezups in cold weather. Long sleeved clothing may be used to minimize skin contact.

9 Physical and chemical properties

• Form:	Liquid
• Color:	Slightly hazy
• Odor:	Not determined
• Melting point/Melting range:	Undetermined.
• Boiling point/Boiling range:	Undetermined.
• Pour point	-20°C (-4°F)
• Flash point:	> 107°C (> 225°F) (seta cc)
• Auto igniting:	Product is not selfigniting.
• Danger of explosion:	Product does not present an explosion hazard.
• Vapor pressure at 20°C (68°F):	.0034 mmHG
• Density at 25°C (77°F):	1.37
• Solubility in / Miscibility with Water:	Fully miscible.
• Viscosity:	
Dynamic at 25°C (77°F):	3000 mPas
• Additional information:	Soluble in lower molecular weight alcohols.

10 Stability and reactivity

- **Thermal decomposition / conditions to be avoided:**

This product is stable at ambient temperatures and atmospheric pressures.

- **Materials to be avoided:**

This product is incompatible with strong oxidizers and contact with strong acids, strong bases and strong oxidizers should be avoided.

- **Dangerous reactions** Hazardous polymerization is not expected to occur.

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- **Dangerous products of decomposition:**
Carbon monoxide and carbon dioxide
Phosphorus oxides (e.g. P₂O₅)
Under wet alkaline or acidic conditions, this product hydrolyzes slowly and nonviolently.
- **Additional information:** Care should be taken to prevent moisture condensation in the container.

11 Toxicological information

· Acute toxicity:

· LD/LC50 values that are relevant for classification:

Oral	LD50	> 5000 mg/kg (rat) No mortality or signs of toxicity.
Dermal	LD50	> 2000 mg/kg (rabbit) No mortality or signs of toxicity.
Inhalation	LC50/4 h	> 2.1 mg/l (rat) Highest attainable concentration. Did not produce mortality or signs of toxicity.

· Primary irritant effect:

· on the skin:

The product was found to be a mild irritant in rabbits following a 4-hour exposure.
In a dermal irritation study in rabbits, this product produced very slight erythema and edema in two animals. The irritation cleared by the 48 hour observation period. There was no irritation seen in the remaining animals throughout the 72 hour observation period.

· on the eye:

This product is a mild to moderate irritant to rabbit eyes.
In an eye irritation study in rabbits, this product produced slight to moderate conjunctival irritation in 4 of the rabbits. The irritation cleared by the 24 hour observation period. There was no irritation seen in the remaining animals during the 72 hour observation period.

· Sensitization: No sensitizing effects known.

· Ingestion: Ingestion may cause digestive tract irritation and gastrointestinal distress.

· Inhalation: Inhalation of this product may cause respiratory tract irritation.

· Mutagenicity:

The product was evaluated for mutagenic activity in the following assays: the Ames Test, Mouse Lymphoma Point Mutation Assay, Mouse Lymphoma Chromosome Aberration and Sister Chromatid Exchange (SCE) Assay and Rat Bone Marrow Cytogenetics Assay (assessing for chromosome aberrations). Using the scientific criteria established by the respective testing laboratories for interpreting the assay results as positive (mutagenic) or negative (not mutagenic), all of the assays were negative, indicating that the product is not mutagenic.

· Carcinogenicity:

The product was evaluated in an in vitro cell transformation assay which is used to predict carcinogenic potential. The product was evaluated in the Syrian Hamster Embryo Cell Assay, which both assesses the ability of a chemical to transform cells and differentiates between genotoxic carcinogens and chemicals which transform cells via an epigenetic mechanism. In this assay, the product was shown to transform Syrian hamster embryo cells by an epigenetic mechanism. The results indicate that the product is not a genotoxic carcinogen.

In a 2 year study conducted by the National Toxicology Program, trimethyl phosphate was administered in the drinking water of rats and mice 3 times per week. Trimethyl phosphate was carcinogenic to female mice (adenocarcinoma of the uterus/endometrium) and produced an increase in benign fibromas in male rats.

· Target organ: Overexposure to this product may affect the skin, eyes and respiratory system.

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12 Ecological information

· **Information about elimination (persistence and degradability):**

· **Other information:**

In the Closed Bottle Test, this product biodegraded 5% at day 28 and 15% at day 140. It is considered not readily biodegradable.

13 Disposal considerations

· **Product:**

· **Recommendation:**

Material that cannot be used or chemically reprocessed should be disposed of in accordance with all applicable federal, state and local regulations.

This product, if unused, does not meet the EPA's criteria as either a listed or characteristic hazardous waste under the Resource Conservations and Recovery Act (RCRA) as published in 40 CFR 261.

· **Uncleaned packagings:**

· **Recommendation:**

Product containers designed for single use should be thoroughly emptied before disposal. Containers should be drained of residual product before disposal. Empty containers should be disposed of in accordance with all applicable laws and regulations.

14 Transport information

· **DOT regulations:**

· **Remarks:** Not regulated for transportation in accordance with the Department of Transportation (DOT) regulations as per 49 CFR (Part 172-180).

· **Maritime transport IMDG:**

· **Marine pollutant:** No

15 Regulations:

· **Sara**

· **Section 355 (extremely hazardous substances):**

75-21-8	ethylene oxide	0.1%
75-07-0	acetaldehyde	0.1%

· **Section 313 (Specific toxic chemical listings):**

This product contains a toxic chemical(s) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372 (annual Toxic Chemical Release Reporting).

75-07-0	acetaldehyde	0.1 max%
75-21-8	ethylene oxide	0.1 max%

· **SARA Title III: Section 304 - CERCLA:**

This product contains a hazardous substance regulated under Section 304 for emergency release notification (CERCLA List).

100% Ethylene oxide (RQ = 10 lbs)

Ethylene oxide in product (0.1%) (RQ = 10,000 lbs)

· **TSCA (Toxic Substances Control Act):** Substance is listed.

· **TSCA Section 12(b) - Export Notification:**

This product does not contain any chemicals subject to Section 12(b) export notification.

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· **Proposition 65**

· **Chemicals known to cause cancer:**

Warning! This product contains chemicals known to the State of California to cause cancer.

75-21-8	ethylene oxide	0.1%
123-91-1	1,4-dioxane	.005%
512-56-1	trimethyl phosphate	1.5%
75-07-0	acetaldehyde	0.1%

· **Chemicals known to cause reproductive toxicity for females:**

Warning! This product contains a substance known to the State of California to cause reproductive toxicity.

75-21-8	ethylene oxide	0.1%
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· **Chemicals known to cause reproductive toxicity for males:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity:**

Warning! This product contains a substance known to the State of California to cause developmental toxicity.

109-86-4	2-methoxyethanol	0.1%
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· **OSHA status:**

This product is considered to be a hazardous chemical under the OSHA Hazard Communication Standard (29 CFR 1910.1200)

· **Chemical Weapons Convention (CWC):**

Contains CWC Schedule 2B chemical (ECCN IC350): Dimethylmethylphosphonate (756-79-6)

Contains CWC Schedule 3B chemical:

(0.01%) Trimethyl Phosphite (CAS No. 121-45-9)

· **Resource Conservation and Recovery Act (RCRA):**

This product is not considered to be a hazardous waste under RCRA (40 CFR 261).

· **Canadian WHMIS Symbol(s):**



· **Canadian WHMIS Classification(s): D2A**

· **State Regulations:**

· **State Right-To-Know**

184538-58-7	Phosphoric acid, triethyl ester, polymer with oxirane and phosphorus oxide (P2O5)	80 - 95%
	Proprietary Epoxy Resin	2.5 - 3.0%
756-79-6	dimethyl methylphosphonate	.001 - 2%
512-56-1	trimethyl phosphate	.001 - 1.5%
75-21-8	ethylene oxide	.001 - 0.1%
75-07-0	acetaldehyde	.001 - 0.1%
109-86-4	2-methoxyethanol	.001 - 0.1%
123-91-1	1,4-dioxane	.001 - 0.005%

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16 Other information

This information in this material safety data sheet should be provided to all who will use, handle, store, transport or otherwise be exposed to this product. All information concerning this product and/or suggestions for handling and use contained herein are offered in good faith and are believed to be reliable as of the date of publication. However, no warranty is made as to the accuracy of and/or sufficiency of such information and/or suggestions as to the merchantability or fitness of the product for any particular purpose, or that any suggested use will not infringe any patent. Nothing in here shall be construed as granting or extending any license under any patent. Buyer must determine for himself, by preliminary tests or otherwise, the suitability of this product for his purposes, including mixing with other products. The information contained herein supersedes all previously issued bulletins on the subject matter covered. If the date of this document is more than three years old, call to make certain that this sheet is current.

· **Department issuing MSDS:** Product safety department (Tel.: 914 269-5900)

USA

CAS REGISTRY NUMBER:

70715-06-9

INVENTORY NAME(S):

Phosphonic acid, methyl-, dimethyl ester, polymer with oxirane and phosphorus oxide
(P₂O₅) (TSCA, NDSL, AICS, ASIA-PAC)

Methylphosphonate de dimethyle polymerise avec l'oxirane et l'oxyde de phosphore
(P₂O₅) (French) (NDSL)

OTHER NAME(S):

Phosphorus pentaoxide, dimethyl methylphosphonate, ethylene oxide polymer

EPA FLAGS:

XU Exempt from Update Rule

FORMULA:

(C₃H₉O₃P.C₂H₄O.O₅P₂)_x

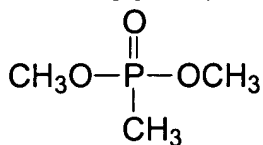
COMPONENT A

1314-56-3

P₂O₅

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

COMPONENT B



756-79-6

C₃H₉O₃P

CGM140742

COMPONENT C



75-21-8

C₂H₄O